

CLINICAL SCIENCE

PHACOEMULSIFICATION VERSUS EXTRACAPSULAR EXTRACTION: GOVERNMENTAL COSTS

Newton Kara-Junior, Maysa Godoy Gomes Mazurek Sirtoli, Marcony Rodrigues Santhiago, Tais Renata Ribeiro Parede, Rodrigo França de Espíndola, Regina de Souza Carvalho

doi: 10.1590/S1807-59322010000400002

Kara-Junior N, Mazurek Sirtoli MGG, Santhiago MR, Parede TRR, Espíndola, RF, Carvalho RS. Phacoemulsification versus extracapsular extraction: governmental costs. *Clinics*. 2010;65(4):357-61.

PURPOSE: To evaluate the governmental costs of patients undergoing phacoemulsification and extracapsular cataract extraction at a public hospital in a developing country.

METHODS: A prospective study was conducted with 205 patients. The subjects were randomized for cataract surgery using either phacoemulsification or extracapsular cataract extraction techniques.

RESULTS: Of the 205 patients, 101 patients were submitted to phacoemulsification and 104 patients were submitted to extracapsular cataract extraction. Brazilian Health Care System expenditures for the surgery and the postoperative period were US\$ 95.49 more in the phacoemulsification group than in the extracapsular cataract extraction group. If we take into account Social Security expenditures, then we estimate that the average difference for the total direct cost for the government for the surgery and the postoperative period for both procedures was US\$ 50.91 or approximately half of the initial difference in cost for the phacoemulsification surgery. The total cost of cataract surgery for the government (excluding social security) was estimated at US\$ 258.79 for extracapsular cataract extraction and US\$ 309.70 for phacoemulsification per patient. Focusing only on working patients, the total cost was US\$ 342.21 for phacoemulsification and US\$ 587.71 for extracapsular cataract extraction, a difference of US\$ 245.50. This difference can be considered monetarily and socially justifiable when the benefits of the surgical technique are evaluated.

CONCLUSION: Under the conditions of this study, we observed that phacoemulsification was an efficient procedure with regard to the impact on public health care system, when all costs are assessed comprehensively, mainly for subjects with regular jobs.

KEYWORDS: Cataract surgery; Phacoemulsification; Extracapsular cataract extraction; Cost; Government.

INTRODUCTION

Cataract surgery with intraocular lens (IOL) implantation is one of the most commonly performed surgical procedures around the world.¹⁻⁴ Today, the main techniques are extracapsular extraction (ECCE) and phacoemulsification (PHACO).

Currently, the PHACO technique is performed in most developed countries due to the possibility of rapid visual recovery and the low complication rate.^{5,6} Leaming et al.⁵ reported that 97% of U.S. ophthalmologists performed at

least one PHACO procedure in 2003. There was an increase of PHACO surgery with foldable IOL in Brazilian public hospitals from 64,761 surgeries in 2006 to 130,498 surgeries in 2007.^{7,8}

Although the Brazilian Health Care System (SUS) pays more for cataract surgery by PHACO, there are still issues related to economic advantages in implementing this procedure instead of ECCE. Considering the lack of information in peer-reviewed literature, this study was carried out to evaluate the governmental costs of cataract surgery by PHACO and ECCE techniques in the public health care system in Brazil.

PATIENTS AND METHODS

This prospective, randomized study comprising senile cataract patients was conducted at a Brazilian public

Ophthalmology Department, Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo - São Paulo/SP, Brazil.

Email: maysa_mazurek@hotmail.com

Tel: 55 11 3069.7873

Received for publication on October 19, 2009

First review completed on December 02, 2009

Accepted for publication on December 29, 2009

hospital, the Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (HC-FMUSP). The Institutional Review Board of the University of São Paulo approved the study. Economic aspects of the postoperative period were studied associated with two surgical cataract extraction techniques (ECCE and PHACO). This study is in accordance with the tenets of the declaration of Helsinki.

The inclusion criteria consisted of age between 41 and 80 years, senile cataract, best corrected visual acuity worse than 20/40 (Snellen) or 0.3 (logMAR) in the better eye, and patients living less than 100 km from the hospital.

The exclusion criteria were the presence of any physical or clinical restrictions, besides the visual problem, the presence of any ocular diseases that could contribute to decreased visual acuity, previous ocular surgery, amblyopia, and refusal to participate in the study or sign the consent form.

Each patient had only one eye operated. Three experienced surgeons performed all surgeries.

The patients were randomized into two groups: patients in the PHACO Group (n=101): underwent PHACO with foldable IOL implantation, and patients in the ECCE Group (n=104) underwent ECCE with polymethylmethacrylate (PMMA) IOL implantation.

For patients undergoing PHACO, follow-up evaluations were scheduled post-operatively at 1-2 days, 7-13 days, and 21-27 days. Follow-up discharge was after the third assessment. When necessary, visual correction was prescribed at discharge.⁹

For patients undergoing ECCE, follow-ups were scheduled post-operatively at 1-2 days, 7-13 days, 28-34 days, 42-48 days, and 56-62 days (date of possible follow-up discharge). If necessary, sutures were removed at the fourth assessment, and an additional review was scheduled for the following week. When necessary, visual correction was prescribed at discharge.⁹

The dependent variables studied were occupational status, number of postoperative returns; a need to be seen by the surgeon on a non-scheduled date, monthly income of subjects with a regular job, and Social Security expenditures during the postoperative period.

The Brazilian Health Care System (SUS) reimbursement for cataract surgery was US\$ 294.95 per PHACO with foldable IOL implantation and US\$ 193.58 per ECCE with PMMA IOL.^{6,8} For each postoperative follow-up, tonometry reimbursement (only on the operated eye) was US\$ 2.72 per procedure. The benefit was granted to any insured patient who was unable to work for more than 15 consecutive days due to illness or accident. In the case of full-time employees the first 15 days were paid by the employer. From the 16th day of absence from work, the payment was made by Social

Security. All Social Security expenditures were estimated from the average wage of individuals who had regular jobs. In both groups, patients remained away from their jobs until they were discharged. After the initial 15 days, we estimated the average Social Security expenditure for each individual worker, based on the number of additional days that the subjects of both groups were away from work. Considering the percentage of subjects with regular jobs, Social Security expenditures were recalculated in both groups to obtain the average expense per patient.

For comparison with the international literature, all the values in this study were converted to U.S. dollars (US\$) at a rate of one dollar for each R\$ 2.18 (Brazilian currency).

Statistical Analysis

Data were processed using Microsoft Access (Office 97). All the statistical tests were performed with SPSS version 10.0 (Statistical Package for Social Sciences™).

Asymmetry values below one were considered parametric and were statistically analyzed by means of the χ^2 test for independent samples. Asymmetry values greater than one were considered non-parametric and were statistically studied with the Mann-Whitney test. A minimum level of 95% statistical significance ($p < 0.05$) was considered for all tests.

RESULTS

The sample was composed of 205 patients. Of these patients, 101 underwent PHACO, and 104 ECCE. The average ages of the PHACO and ECCE groups were 68.3 years \pm 9 years and 69.1 years \pm 8.5, respectively ($p = 0.70$). Regarding gender, 35.3% and 44.1% of patients were male in the PHACO and ECCE groups, respectively ($p = 0.40$). Table 1 shows the occupational distribution by type of surgery. The percentage of patients employed was 16.83% in the PHACO group and 13.46% in the ECCE group.

Table 2 lists the average wages of employed patients, divided by type of surgery. The groups showed no statistical differences.

The Social Security expenditures were estimated from the average wage of the employed subjects (Table 2). After 15 days of absence, the average Social Security cost for each individual worker was estimated at US\$ 39.08 in the PHACO group, in which the patients took 6 additional days off work. In the ECCE group, patients took an 47 additional days away from work, corresponding to an average estimated Social Security cost of US\$ 380.07 per subject. Considering the percentage of regularly employed subjects in both groups (16.83% in the PHACO group and 13.46% in the ECCE

Table 1 - Occupational statuses of patients in the phacoemulsification (PHACO) and extracapsular extraction (ECCE) groups.

Work status	Retired	Homemaker	Employed	LFJ	NLFJ/NRJ
PHACO	49 (48.04%)	25 (43.86%)	17 (54.84%)	5 (55.56%)	5 (83.84%)
ECCE	53 (51.96%)	32 (56.14%)	14 (45.16%)	4 (44.44%)	1 (16.66%)
Total	102 (100%)	57 (100%)	31 (100%)	9 (100%)	6 (100%)

N=number of patients

* LFJ, Looking for a job (currently unemployed)

** Not looking for a job / no regular job (unemployed and not looking for a job / informal job)

Table 2 - Comparison of the monthly average wage of employed patients who underwent either phacoemulsification (PHACO) or extracapsular extraction (ECCE).

	PHACO (17 patients)		ECCE (14 patients)		Total	
	Mean	SD	Mean	SD	Mean	SD
Salary (US\$)	195.42	51.81	242.60	112.85	216.97	86.69

SD=Standard deviation

Table 3 - Estimated Social Security costs per patient who underwent phacoemulsification (PHACO) or extracapsular extraction (ECCE).

Group	Number of days away from work	Mean costs for the government per employed patient (US\$)	Mean costs for the government per operated patient (US\$)
PHACO (n=17)	6	39.08	6.57
ECCE (n=14)	47	380.07	51.15

group), the average cost for Social Security support per patient was estimated at US\$ 6.57 in the PHACO group and US\$ 51.15 in the ECCE group (Table 3).

For each postoperative follow-up, a tonometry examination (only on the operated eye) was performed. This procedure is paid separately by the SUS, which was estimated at US\$ 2.72 per procedure. The PHACO group averaged 3 postoperative returns, and the ECCE group averaged 5.17 returns. Thus, the PHACO group's postoperative visits generated a cost of US\$ 8.18 for the SUS, while the ECCE group generated an additional cost of US\$ 14.06 for their 5.17 returns.

DISCUSSION

In the past 10 years the technique used for cataract surgery has improved, with an increase in surgeries performed using the PHACO technique.^{2,7,8} However, its use in public health systems challenged the economic feasibility in developing countries, due to cost overrun concerns. In the context of increased costs, using financial resources for this procedure could result in fewer funds being available for other needs.¹⁰⁻¹³ The use of a PHACO technique with foldable IOL implantation in the public health care systems of developing countries is not generally encouraged by the international community, despite the consensus in the

literature as to its clinical benefits and reduced individual expenses.¹³⁻²⁰

Since 2001, PHACO with foldable IOL implantation has been financed by the Brazilian Health Care System. Because there is no research in the national literature that justifies the real economic advantage of the PHACO technique, this study was designed to analyze the economic parameters of this technique compared to ECCE.

In this study, both groups were homogeneous (Table 1). Other national studies also reported similar characteristics for patients selected for cataract surgery in public hospitals. In San Manuel, São Paulo, Brazil, Kara-Junior et al.¹⁹ reported a cohort that was 38.5% male. In Recife, Pernambuco, Brazil, Lima et al.²⁰ observed a mean age of 68.9 years, and 30.7% of patients were male. According to current Brazilian Institute of Geography and Statistics (IBGE) analyses, 36.0% of the population aged over 50 years was economically active. While the average age of subjects in the sample of this study was over 60 years, the proportion of economically active subjects (an average of 15.21% in both groups) was probably below the national standard for that age group (Table 1).

Regional differences between developed and developing countries may also influence the cost of cataract surgery. In a Brazilian public hospital that performed a high number of cataract surgeries, KARA-JUNIOR et al.²¹ estimated that

the expenditures for the government were US\$ 242.23 for the PHACO and US\$ 155.50 for the ECCE technique, per patient.

Currently, the Brazilian Health Care System reimbursement for cataract surgery by PHACO with foldable IOL implantation is US\$ 294.95 per procedure and by ECCE with PMMA IOL is US\$ 193.58¹⁰ per procedure, resulting in a difference of US\$ 101.37.

For each postoperative tonometry procedure (only on the operated eye), financing was US\$ 2.72, so that subjects in the PHACO group generated a cost of US\$ 8.18 over an average of 3.00 postoperative return visits, while the ECCE group generated an additional cost of US\$ 14.06 over an average of 5.17 return visits. Thus, for the surgery and postoperative follow-up, the Brazilian Health Care System pays US\$ 303.13 for PHACO and US\$ 207.64 for ECCE, resulting in a difference of US\$ 95.49.

The estimated average cost for Social Security due to absence from work during the postoperative period (after the initial 15 days of salary for the absent employee, which is paid by the employer) per operated patient was US\$ 6.57 in the PHACO group and US\$ 51.15 in the ECCE group (Tables 2 and 3). The difference of US\$ 44.58 represents the estimated additional average expenditures for each subject from the ECCE group. This must be added to the total public costs of the surgery, even if the cost burdens fall to different payers (Ministry of Health versus Social Security). Brazilian Health Care System expenditures for the surgery and the postoperative period were US\$ 95.49 more per patient in

the PHACO group than in the ECCE group. Taking into account Social Security expenditures, the average difference for the total direct cost to the government between the two procedures was US\$ 50.91 or approximately half of the initial difference in cost of the PHACO surgery. This difference can be considered monetarily and socially justifiable when the benefits of the PHACO surgical technique are taken into account.

Therefore, for each patient with a regular job who underwent cataract surgery, the total direct cost for the government was estimated at US\$ 342.21 for PHACO and US\$ 587.71 for ECCE, a difference of US\$ 245.50 (Table 3). Under the conditions of this study, there is a significant economic advantage in favor of PHACO, especially if the patient is economically active. One of the basic principles of economics in the public health care system is to adopt rational measures that will provide cost savings without having a negative impact on health. Thus, to introduce a novel procedure, it is essential to analyze the efficiency. Efficiency is measured by the improvement in quality of life taking into account the economic impact of the technique on the health care system. In conclusion, we consider that PHACO is an efficient procedure in Brazil with regard to its impact on the public health care system when all costs are assessed. These findings provide important information for Brazilian health policy officials. The entities responsible for planning public health expenditures must reconcile the strong demand for medical care with the limited resources available for financing purposes.

REFERENCES

1. Albanis C, Dwyer MA, Ernest T. Outcomes of extra-capsular cataract extraction and phacoemulsification performed in a University training program. *Ophthalmic Surg Lasers*. 1998;29:643-8.
2. Leaming DV. Practice styles and preferences of American Society of Cataract and Refractive Surgery (ASCRS) members-1998 Survey. *J Cataract Refract Surg*. 1999;25:851-9.
3. Mendes MH, Betinjane AJ, de Sá Cavalcante A, Cheng CT, Kara-José N. Ultrasonographic findings in patients examined in cataract detection-and-treatment campaigns: a retrospective study. *Clinics*. 2009;64:637-40.
4. Kara-Junior N, de Santiago MR, Kawakami A, Carricondo P, Hida WT. Mini-rhexis for white intumescent cataracts. *Clinics*. 2009;64:309-12.
5. The Royal College of Ophthalmologists of London. Cataract surgery guidelines. London, 2001.
6. Lundstrom M, Stenevi U, Thorburn W. The Swedish National Cataract Register: a 9-year review. *Acta Ophthalmol Scand*. 2002;80:248-57.
7. Santiago MR, Gomes BAF, Gaffree FFP, Varandas VS, Costa filho AAC. Tendências evolutivas dos cirurgões de catarata presentes no IV Congresso Brasileiro de Catarata e Cirurgia Refrativa. *Rev Bras Oftalmol*. 2009;68:13-7.
8. Ministério da Saúde. Sistema de Informações Ambulatoriais do SUS (SIA/SUS). Available on: <http://tabnet.datasus.gov.br/cgi/defthtm.exe?sia/cnv/parf.def>.
9. Ionides A.; Clauoué C. Resource management of cataract patients: can visual rehabilitation be achieved in three visits? *J Cataract Refract Surg*. 1996;22:717-20.
10. Secretaria da Saúde (Estado de São Paulo). Tabela do SUS para procedimentos ambulatoriais. Available on: www.saude.sp.gov.br, 2002.
11. Minassian DC, Rosen P, Dart JKG. Extracapsular cataract extraction compared with small incision surgery by phacoemulsification: a randomised trial. *Br J Ophthalmol*. 2001;85:822-9.
12. Kara-Junior N, Avakian A, Lower LMT, Rocha AM, Cursino M, Alves MR. Phacoemulsificação versus extração manual do cristalino: análise de custos. *Arq Bras Oftalmol*. 2004;67:481-9.
13. Taylor HR, Sommer A. Cataract surgery. A global perspective. *Arch Ophthalmol* 1990;108:797-8.
14. Ohrloff C, Zubcov AA. Comparison of phacoemulsification and planned extra-capsular extraction. *Ophthalmologica*. 1997;211:8-12.

15. Schwab L. Eye care delivery in developing nations: paradigms, paradoxes, and progress. *Ophthalmic Epidemiol.* 1994;1:149-54.
16. Gogate P, Deshpande M, Nirmalan PK. Why do phacoemulsification? Manual small-incision cataract surgery is almost as effective, but less expensive. *Ophthalmology.* 2007;114:965-8.
17. Kara-Junior N, Schellini SA, Silva MRBM, Bruni LF, Almeida AGC. Projeto Catarata – Qual a sua importância para a comunidade? *Arq Bras Oftalmol.* 1996;59:490-6.
18. Lima DMG, Ventura LO, Brandt CT. Barreiras para o acesso ao tratamento da catarata senil na Fundação Altino Ventura. *Arq Bras Oftalmol.* 2005;68:357-62.
19. Instituto Brasileiro de Geografia e estatística. Available on: http://www.ibge.gov.br/home/estatistica/populacao/condicaodevida/indicadoresminimos/supme/default_educacao.shtm
20. van den Berkt AC, de Waard PW, Pameijer JH. Comparison between postoperative astigmatism after classic extracapsular lens extraction and after phacoemulsification with implantation of a Pearce tripod or Pearce vaulted y-loop intraocular lens. *Doc Ophthalmol.* 1992;82:1-7.
21. Yorton Y. Are intraocular lenses the solution to cataract blindness in Africa? *Br J Ophthalmol.* 1998;82:467-71.
22. Brown MM, Brown GC. How to interpret a healthcare economic analysis. *Curr Opin Ophthalmol.* 2005;16:191-4.
23. Kara-Junior N. Cirurgia de catarata: aspectos clínicos e socioeconômicos; Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo – 2002. (tese). São Paulo, Faculdade de Medicina da Universidade de São Paulo;2003.
24. Watson A, Sunderraj P. Comparison of small-incision phacoemulsification with standard extra-capsular cataract surgery: post-operative astigmatism and visual recovery. *Eye.* 1992;6:626-9.
25. Cavallini GM, Lugli N, Campi L, Lazzerini A, Longanesi L. Surgically induced astigmatism after manual extra-capsular cataract extraction or after phacoemulsification procedure. *Eur J Ophthalmol.* 1996;6:257-63.
26. Muller-Jensen K, Barlinn B, Zimmerman. Astigmatism reduction: no-stitch 4.0 mm versus sutured 12.0 mm clear corneal incisions. *J Cataract Refract Surg.* 1996;22:1108-12.
27. Zheng L, Merriam JC, Zaider M. Astigmatism and visual recovery after “large incision” extra-capsular cataract surgery and “small” incisions for phacoemulsification. *Trans Am Ophth Soc.* 1997;95:387-415.
28. Apple D, Solomon K. Posterior capsule opacification. *Surv Ophthalmol.* 1992;37:73-116.
29. Muralikrishnanr MHM, Venkatesh R, Venkatesh P, Frick K. Economic cost of cataract surgery procedures in an established eye care centre in Southern India. *Ophthalmic Epidemiology.* 2004;11:369-80.
30. American Academy of Ophthalmology. *International Ophthalmology.* San Francisco, 2002:369.
31. Chang DF. Factoring cost, is phacoemulsification still the procedure of choice? *Br J Ophthalmol.* 2001;85:765-6.

